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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

TECHNICAL ASSISTANCE REPORT
TA 80-48

CHEMICAL RECOVERY SYSTEMS, INC.
ELYRIA, OHIO

JULY 1980

I. SUMMARY

On March 19, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United States Environmental Protection Agency (EPA) Office of Enforcement, Hazardous Waste Enforcement Task Force, to evaluate potential worker exposure to organic solvent vapors and the working conditions at Chemical Recovery Systems, Inc., Elyria, Ohio (SIC 2816). To determine the extent of exposure, an industrial hygiene survey was conducted. Personal and area air samples for determination of solvent vapor concentrations were taken. Bulk samples were obtained and analyzed for use as authentic standards. Explosion level measurements were performed.

Vapor concentrations in every sample taken were below the NIOSH recommended standards. Solvents in use at the facility which were identified and quantitated were: acetone, 1,1,1 trichloroethylene, methyl ethyl ketone (MEK or 2-butanone), methylene chloride, trichloroethylene, methyl isobutyl ketone (MIBK or hexone), toluene, xylene, n-butyl acetate, and cellosolves. All personal samples showed exposures less than 18% of the mixture Permissible Exposure Limit (PEL) enforced by the Occupational Safety and Health Administration (OSHA), while area samples gave values of 92% and 21% of the recommended standard. There were no explosion hazards, as evaluated by explosion meter and inspection.

On the basis of data obtained in this investigation, NIOSH determined that no hazards existed due to solvent exposure at Chemical Recovery Systems, Incorporated. Recommendations to maintain safety and health are made on page 4.

II. INTRODUCTION

On March 19, 1980, a request for technical assistance was received from the director of Hazardous Waste Enforcement Task Force, Washington, D.C. The purpose of the study was to evaluate the extent of worker exposure to organic solvent vapors which are produced during the processing and reclamation of assorted solvents at Chemical Recovery Systems, Inc.

III. BACKGROUND

Chemical Recovery Systems Inc. (CRS), is a reclaiming process which cleans "dirty," i.e. used, and/or grease-laden solvents. The solvents to be processed are received in tanker quantities (4000 - 6000 gallons), and are processed in one of two ways: redistilled by thin-film evaporation or dewatered (dried) by contact with calcium chloride.

The site has three areas: 1) Thin film evaporation (TFE) or "still," 2) The yard, and 3) Paint thinner drying area (PTD). The distillation apparatus for TFE is housed in a concrete building that is well ventilated by natural means. One operator is required to monitor and control the essentially continuous distillation. An important consideration in this operation is adjusting the rate of distillation so that the solvent vaporizes without the impurities plating out on the reactor vessel walls. Relatively clean solvents can be distilled at a rate near 400 gallons/hour, while lesser quality products may run at only 75 gallons/hour. Levels of contaminant in the area are thought to be proportional to distillation rate.

Solvents which are frequently processed by TFE are: toluene, methylene chloride, hexane, MIBK, and xylene. The operator's presence in the building and attention to the process is required for about ten minutes of each hour. His major responsibilities are coupling the dirty solvent tanker to the process inlet, greasing motor bearings, monitoring distillation rate, and checking boiler pressure. Clean solvent is directly pumped into a waiting tanker and the residue is piped into a waste or "slop" tanker.

Yardmen perform a variety of tasks, but during NIOSH's visit, their activity was primarily affecting the relocation and restacking of 55-gallon drums. There are more than 1000 drums on the premises which contain varying amounts of waste solvents. CRS claims that the majority of the drums are empty and were left by the previous owners of the operation, Obetts, Inc.

One operator is necessary to manage the paint thinner drying area. Solvents which comprise thinner are usually toluene, xylene, acetone, methyl ethyl ketone, methyl isobutyl ketone, isopropanol, and cellosolves. Different thinners are composed of differing percentages of the aforementioned solvents. As with the TFE operation, the worker's presence is required for only a small percentage of the shift. He must couple the dirty solvent tanker to the pumps, drain water from the drying bed, check storage tank levels, and fill clean thinner tankers. The operation is inside an open, well-ventilated building.

Six employees man the day shift, two on the evening shift. The average length of service is 8.5 years with a range of 6 months - 25 years. Average age is 41 years, with a mode of 33 years. Thirty-three (33) is a better approximation of the average age of the workers. One employee is 66 years old and has been working on site for 25 years.

Non-directed medical questionnaires were solicited and all replies to the question, "Do you have any health problems which you feel might be related to your work?", were negative. It was consensus that all employees were satisfied with their jobs and their working conditions.

IV. METHODS AND MATERIALS

Personal and area sampling for organic vapors were performed using SKC pumps at 100 ml/min pulling workspace air through charcoal tubes. The tubes were eluted with carbon disulfide and analyzed by gas chromatography. The two employees on the evening shift, one each at TFE and PTD, were monitored on April 23, 1980. On April 24, 1980, the day shift was evaluated (2 "still" operators, 3 yardmen, and 1 office employee). Explosion measurements were taken in all areas of the site using a J&W Super-Sensitive Gas Meter. An HNU photo-ionization detector was used as a solvent sniffer to isolate high exposure zones around the work areas.

V. EVALUATION CRITERIA

Prolonged skin contact with solvents may cause primary skin irritation, or irritation of mucous membranes. Inhalation of high concentrations of certain solvents may lead to narcosis and organ damage. Exposure was judged against NIOSH recommended criteria where applicable and ACGIH (American Conference of Governmental Industrial Hygienists) criteria (Threshold-Limit Values), if NIOSH data was not available (Table I). When two or more contaminants are present in workspace air, their combined effect, rather than that of any individual agent should be given consideration. On the absence of contrary information, the effects of a mixture are to be considered additive. Combined exposure can be calculated by summing the exposures for each specie in a mixture according to the expression,

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} \dots \frac{C_n}{T_n}$$

where C indicates the observed ambient concentration of contaminant and T equals the corresponding threshold (permissible exposure) limit values. If the sum exceeds unity, then the exposure limit should be considered exceeded.

VI. RESULTS

The results of the environmental monitoring survey are summarized in Table II. Benzene was not present in any of the samples. Qualitatively, the most varied and highest exposures occur in the PTD area, although personal exposure is minimal. An eight-hour area sample revealed that the exposure to an employee occupying the work area for the entire eight-hour shift would be 92% of the accepted standard.

Likewise, personal and area sampling of the TFE area showed that even constant attention to the operation would incur an exposure of 21% of the recommended mixture TWA. During the NIOSH survey the distillation rate was around 400 gallons per hour, which is a maximum for the process. It can be assumed that exposures would be less during other, less vigorous solvent recovery. All but one employee had exposures less than 18% of the recommended values. The mixture TLV takes into account the effects of exposure to a mixture of contaminants and is a more stringent basis for evaluating the personal health of the worker.

Explosion measurements failed to detect any explosive mixture in each situation examined. Inspection of the site did not reveal any situations where an explosive mixture might be confined, nor were any overt fire hazards observed. All smoking is done outdoors or in the lunchroom area. Common sense was observed by the workers in regard to the potential hazard caused by careless use of smoking materials.

Some of the drums on the premises were noticed to be precariously stacked and a few were leaking. In general, however, housekeeping was adequate and the drums were intact.

VII. DISCUSSION AND CONCLUSIONS

Workers at Chemical Recovery Systems, Inc. were not exposed at the time of the survey to concentrations of organic solvent vapors which may be considered detrimental to their health and well-being. Conditions of the worksite, while not optimal, appear to be safe and require only minor revisions from an occupational health standpoint. The work practices, which were observed during the NIOSH visit, were in accord with those recommended for that type of industry, e.g., neoprene gloves were worn when employees handled raw solvents.

VIII. RECOMMENDATIONS

Yardmen at Chemical Recovery Systems, Inc. should continue to adequately stack or restack the drums on the premises with the most heavily loaded drums resting securely on the ground. Continued disposal of unused drums is recommended.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Study Conducted By:

William N. Albrecht
Dawn Gilles Tharr
Industrial Hygienists
Industrial Hygiene Section
Hazard Evaluations and
Technical Assistance Branch
Division of Surveillance, Hazard
Evaluations and Field Studies

Originating Office:

Hazard Evaluations and
Technical Assistance Branch
Division of Surveillance, Hazard
Evaluations and Field Studies
Cincinnati, Ohio

Report Typed By:

Sandra Kerdolff
Clerk Typist
Industrial Hygiene Section

X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Services (NTIS), Springfield, Virginia 22161.

Copies of this report have been sent to:

- 1) Chemical Recovery Systems, Inc.
- 2) Employee Representatives, CRS., Inc.
- 3) Environmental Protection Agency, Region V
- 4) OSHA, Region V
- 5) NIOSH, Region V

For the purpose of informing the "affected employees," the employer shall promptly "post" the determination report for a period of 30 days in a prominent place near where the exposed employees work.

TABLE I

PERMISSIBLE TWA EXPOSURE LEVELS IN PPM

	<u>Acetone</u>	<u>1,1,1 Trichloro- ethane</u>	<u>Methyl ethyl ketone</u>	<u>Methylene chloride</u>	<u>Trichloro- ethylene</u>	<u>Methyl iso- butyl ketone</u>	<u>Toluene</u>	<u>Xylene</u>	<u>n-butyl acetate</u>
NIOSH ¹	1,000	350 (ceiling 15 min.)	200	75	25	100	100	100	150
ACGIH ²	750	350	200	100	50	50	100	100	150
OSHA ³	1,000	350	200	100	100	100	100	100	150
IDLH ⁴	20,000	1,000	3,000	5,000	1,000	3,000	2,000	10,000	10,000

1. NIOSH Recommended Exposure Limit
2. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1979.
3. Permissible Exposure Limit - 29 CFR 1910.1000 (1977).
4. Immediately Dangerous to Life or Health

TABLE II

TIME WEIGHTED AVERAGE EXPOSURE TO ORGANIC SOLVENTS IN PPM AT CHEMICAL RECOVERY SYSTEMS INC.
ELYRIA, OHIO

April 23-24, 1980

<u>LOCATION</u>	<u>SAMPLE</u>	<u>ACETONE</u>	<u>1,1,1 TRICHLORO- ETHANE</u>	<u>MEK</u>	<u>METHYLENE CHLORIDE</u>	<u>TRICHLORO ETHYLENE</u>	<u>MIBK</u>	<u>TOLUENE</u>	<u>XYLENE</u>	<u>n-BUTYL ACETATE</u>	<u>CELLOSOLVE</u>	<u>CELLOSOLVE ACETATE</u>	<u>ADDITIVE EFFECTS</u>
PTD	Personal 1	9.6	1.9	9.7	5.5	0.3	0.2	2.3	0.6				.18
TFE	Personal 2			0.7	3.0			4.9	0.3				.10
PTD	Area 1	28.4	4.5	36.8	37.1		1.1	11.7	5.6	1.8	1.4	0.7	.92
Y	Personal 3			0.5	3.0		0.2	1.6					.06
Y	Personal 4							1.1	0.4				.02
TFE	Personal 5			0.4				10.2	0.3				.11
TFE	Area 2			0.9			0.2	19.6	0.5				.21
PTD	Personal 6			2.9			0.2	2.3	0.7				.05
Y	Personal 7							0.5					.005
T	Personal 8							0.6					.006
Permissible Exposure Level		1000	350	200	75	25	100	100	100	150			1.0

September 5, 1980
TA 80-48

Mr. Francis J. Siros
Environmental Scientist
Hazardous Waste Enforcement Task Force
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Siros:

Enclosed for your information are copies of our final Hazard
Evaluation and Technical Assistance Report TA 80-48.

Thank you for your interest in maintaining safe and healthful
working conditions. If I may be of further assistance, please
feel free to contact me at (513) 684-2176.

Sincerely yours.

James M. Malus, M.D.
Chief
Hazard Evaluations and Technical
Assistance Branch
Division of Surveillance, Hazard
Evaluations and Field Studies
V-100-80-48

3 Enclosures

cc:
File Copy
DSHEFS File
J. Flesch
Malus:mh:Rm9405:FOB:Cinti:OH

RC Reg. V
W. Albrecht
L. Ascierio ✓